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Mobilising new frontiers in digital transformation research: A problematization review

Amir Ashrafi[1] | Panos Constantinides[2] | Nikolay Mehandjiev[2] | Jason Bennett Thatcher[3]

[1]Brunel Business School, Brunel University London, London, UK

[2]Alliance Manchester Business School, University of Manchester, Manchester, UK

[3]Leeds School of Business, University of Colorado, Boulder, Colorado, USA

Correspondence
Amir Ashrafi, Brunel Business School, Brunel University London, London, UK
Email: amir.ashrafi@brunel.ac.uk

Abstract

In this paper, we mobilise new frontiers in digital transformation (DT) research by deconstructing the literature's underlying assumptions and analysing their correspondence with current theory. To do so, we conduct a problematization review across the fields of IS, strategy and entrepreneurship, organisation theory and management studies, to capture the multidimensionality of DT research. Unlike systematic literature reviews commonly found in DT research, a problematization review critically questions how theoretical contributions have been constructed in past research to develop novel theoretical questions. Our findings offer three contributions. First, we uncover five research trajectories, each with its own in-house assumptions about the nature of digital technologies and how organisations, groups and individuals interact with those technologies and the data they generate. Second, we show how individual studies within the identified research trajectories position themselves against prior research, pointing at six distinct processes of constructing theoretical contributions. Finally, we mobilise new frontiers of research by questioning DT research field assumptions that cut across the five research trajectories. We

conclude by discussing the theoretical implications of our problematization review for further DT research.

KEYWORDS
digital transformation (DT), DT frontiers, DT research trajectories, field assumptions, problematization review

1 | INTRODUCTION

Digital Transformation (DT) research largely reflects an organisational-level narrative about the need for strategic change through the development of new business models with digital technologies (Hanelt et al., 2021; Verhoef et al., 2021). For example, the strategic management literature raises questions about the nature of the firm and competition in light of multi-sided platform ecosystems (Jacobides et al., 2018; Kretschmer et al., 2022) that render firm strategies interdependent in ways that traditional strategic 'positioning' does not (Menz et al., 2021). In the information systems (IS) literature, researchers have examined how new digital technologies have challenged existing socio-technical structures with implications for value creation processes (Baiyere et al., 2020; Nambisan et al., 2017; Vial, 2019; Wessel, Baiyere, Ologeanu-Taddei, Cha, & Blegind-Jensen, 2021).

While DT has high strategic relevance for organisations and attracted attention across research fields, it is important to further explore the dimensions of DT. DT is multidimensional, it is important to challenge our assumptions about how organisations strategize, compete, and create value with different technologies. DT also challenges our assumptions about, for example, how organisational practices are remotely managed through algorithms (Möhlmann et al., 2021), and how smart contracts in blockchain infrastructures challenge our views of decentralised technology governance (Halaburda et al., 2023).

Most past reviews on DT research have largely adopted a systematic approach to synthesise he literature (Hanelt et al., 2021) and to create a theoretical framework for studying DT (Vial, 2019). Systematic literature reviews are valuable in achieving construct clarity by summarising the empirical findings described in previous research and the theoretical insights derived from those (Vial, 2019). Systematic literature reviews are also great in identifying gaps in past research and providing a framework for positioning new research (Okoli, 2015).

However, exactly because digital technologies are *emerging*, that is, they are "always changing and adapting" (Bailey et al., 2022), our exploration of the various dimensions of DT "does not lie in validated knowledge, but rather in the suggestion of relationships and connections that had not previously been suspected, relationships that change actions and perspectives" (Weick, 1989, p. 524). In other words, to advance we cannot depend on simply reviewing past research to synthesise perspectives, but rather in problematizing anomalies in past knowledge to generate opportunities for novel ways of thinking (Alvesson & Sandberg, 2020).

In contrast to systematic literature reviews, problematization reviews are not meant to identify gaps in order to formulate new research questions, in fact, quite the opposite (Sandberg & Alvesson, 2011). Problematization reviews critically question how theoretical contributions have been constructed in past research to develop novel theoretical questions (Alvesson & Sandberg, 2020). As others have stressed, there is a need to problematize how research from diverse fields have theorised DT phenomena while "question[ing] the explanatory power and usefulness of extant theory and assumptions" (Monteiro et al., 2022). Problematization reviews are well suited in unearthing the multi-dimensionality of DT to mobilise new research frontiers (cf. Dolata et al., 2022; Gkeredakis & Constantinides, 2019).

In this paper, we conduct a problematization review of the literature on DT research spanning two decades (2000–2023) and journals across the fields of IS, strategy and entrepreneurship, organisation theory and management studies. We use a bibliometric method (i.e., citation analysis) to identify a core corpus of DT studies (Alvesson & Sandberg, 2020). In this effort, while acknowledging the breadth of research on DT, we "read broadly

but selectively… [by] focus[ing] on some core and representative readings within the target (sub)domain" (Alvesson & Sandberg, 2020, p. 1298). Core and representative readings are influential in creating new research trajectories so that subsequent studies build on these readings to to extend key theoretical constructs and frameworks incrementally. These readings do not represent *all* research on a topic, but influence how others construct theoretical contributions. Thus, in a broad but selective reading, the key goal is not to be comprehensive in our review, but rather to identify path creating studies from which we can trace the map of theoretical assumptions about DT phenomena. Following Locke and Golden-Biddle's (1997) method of problematizing literature, we examine how past research constructs theoretical contributions. We then identify key assumptions in this theorising and mobilise new frontiers for research.

We make three contributions that are closely related to the key objectives of the special issue. First, we provide evidence of five research trajectories generated by the studies in our core corpus and fuelled by subsequent studies. These fundamental research trajectories focus on *digital technology architectures*, *digital business models and new forms of value creation*, *new organisational forms enabled by digital technologies*, *digital technology affordances and the relationality of work practices*, and *the role of organisational identity, culture, and leadership in DT*. We find that each of these research trajectories makes unique "in-house assumptions"—that is, assumptions accepted as unproblematic by a particular school of thought (Alvesson & Sandberg, 2011)—about the nature of digital technologies, but also about the ways in which organisations, groups and individuals interact with those technologies and the data they generate. At the same time, we also find that many of these research trajectories depend on the same "field assumptions"—that is, a broader set of assumptions about digital technology that are shared by several different schools of thought (Alvesson & Sandberg, 2011). We show, for example, that the research trajectory on *new organisational forms enabled by digital technologies* has made assumptions about how organisations form collaborative relationships outside of arms-length contract agreements that rely primarily on technological modularity (Jacobides et al., 2018). While the focus is on the new nature of economic activity and the co-opetition between firms (the in-house assumptions), there is also an acknowledgement of the nature of digital technology, in particular its modularity, that cuts across other research trajectories (the field assumptions). Identifying both the in-house and the field assumptions is important for (a) understanding the incremental innovations to knowledge within each research trajectory, and (b) identifying those path breaking studies that mobilise new research froniters. These are important points to which we return to in our third contribution below.

Second, we problematize how studies in the five research trajectories on DT position themselves in relation to earlier research in order to construct theoretical contributions. We unearth six processes, including *synthesising*, *extending*, and *negating* extant knowledge, but also *identifying oversights*, *filling incomplete knowledge*, and *pointing at the incommensurability of our knowledge*. We provide evidence for these processes even in more recently published research, extending our findings beyond the core corpus of studies. For example, the research trajectory on *digital technology architectures* has relied on the in-house assumption that digital technologies such as mobile application platforms engender unbounded growth—that is, "generativity"—compared to internally developed software systems (Henfridsson & Bygstad, 2013; Tilson et al., 2010; Yoo et al., 2010). Subsequent studies have extended this research trajectory by pointing at two types of generativity, namely, product generativity (Cennamo & Santaló, 2019) and user generativity (Shaikh & Vaast, 2016). Yet, more recent research has synthesised these two types of generativity to show that generativity does not always lead to growth, but can be bounded (Fürstenau et al., 2023). Unearthing these processes of constructing theoretical contributions is important for understanding how researchers within the same research trajectories challenge in-house assumptions, but also how they occasionally acknowledge the limitations of our current perspectives (esp. those pointing at the incommensurability of our knowledge).

Third, and following from the above, we establish links between key research trajectories and core theoretical assumptions, as well as ways of constructing theoretical contributions in DT research (i.e., *how* theoretical contributions are made) with implications for mobilising new frontiers into DT phenomena (i.e., *what* important, novel questions we should pursue). In particular, we argue that if we are to create entirely new research trajectories, we need to focus less on in-house assumptions and more on field assumptions. Challenging field assumptions are more

complex than in-house assumptions because the former are shared across schools of thought and rarely critiqued. Still, if we are to mobilise new frontiers of research on DT, we need to break the mould of established research trajectories, thus, moving beyond in-house assumptions. We discuss how further research can challenge the field assumptions identified in our problematization review to create new research trajectories in DT. This becomes particularly important when emerging digital technologies generate new challenges to the ways of organising business and social practices, as in the case of generative AI.

2 | A PROBLEMATIZATION REVIEW OF THE LITERATURE ON DIGITAL TRANSFORMATION: IDENTIFYING KEY RESEARCH TRAJECTORIES AND ASSUMPTIONS

2.1 | Inherent value of problematization reviews

To synthesise and analyse prior studies, systematic literature reviews (SLR) and problematization reviews represent two distinct methodologies, each serving a unique purpose with differing approaches. Both systematic literature reviews and problematization reviews hold essential roles within the academic and research domains. Understanding these differences is vital for researchers. While systematic reviews serve as the groundwork for comprehending current knowledge, problematization reviews act as catalysts for challenging established paradigms and triggering shifts in academic thought.

SLRs are established methodologies aimed at identifying, evaluating, and synthesising the existing knowledge on a specific research question or topic. The primary goal is to provide an impartial and comprehensive overview of the current state of knowledge within a particular field (Vial, 2019). They often involve assessing the quality of evidence and its implications for evidence-based decision-making (Hanelt et al., 2021). Systematic reviews may also encompass activities such as identifying gaps in existing research (Verhoef et al., 2021). Problematization reviews, on the other hand, center on the critical examination of the underlying theoretical and conceptual foundations in a specific domain of study (Dolata et al., 2022). These reviews aim to identify and challenge the assumptions, theories, and paradigms that underpin established research (Alvesson & Sandberg, 2011). Their principal objective is to introduce fresh perspectives and novel research directions, thereby expanding the intellectual boundaries of a given field (Alvesson & Sandberg, 2020).

Further, SLRs adhere to a highly structured and replicable methodology, encompassing comprehensive literature searches, well-defined selection criteria, rigorous data extraction, and assessments of quality and relevance (Vial, 2019; Webster & Watson, 2002). They prioritise objectivity, comprehensiveness, and transparency, and often employ quantitative analysis and statistical techniques (Kraus et al., 2021). In contrast, problematization reviews adopt an interpretive methodology (Gkeredakis & Constantinides, 2019). They rely heavily on qualitative analyses and in-depth engagement with existing literature (Locke & Golden-Biddle, 1997). These reviews emphasise the critical exploration of the theoretical foundations of research within a specific field, encouraging the identification of conceptual limitations and the challenging of conventional wisdom (Alvesson & Sandberg, 2011, 2020).

In summary, both problematization reviews and SLRs have their strengths and limitations and each serves different objectives. In this paper, aligned with the objectives of the special issue, we were interested in mobilising new frontiers in DT research. As such, we adopted a problematization review as the preferred approach to stimulate a reexamination of the fundamental assumptions in IS research, potentially introducing fresh perspectives by questioning whether the existing theoretical foundations are adequate for explaining the emerging dimensions of DT.

2.2 | Corpus building

As a first step in our problematization review of the literature on DT research, we reviewed papers published from 2000 to 2023 in IS journals (*MIS Quarterly*, *Information Systems Research*, *Journal of Management Information Systems*,

Journal of the Association of Information Systems, *Information and Organisation*, *European Journal of Information Systems*, *Information Systems Journal*, *Journal of Information Technology*, *the Journal of Strategic Information Systems*, *Decision Support Systems*, *Information & Management*, and *International Journal of Electronic Commerce*), as well as journals representing organisation theory, strategy and management (*Administrative Science Quarterly*, *Management Science*, *Academy of Management Journal*, *Academy of Management Review*, *Journal of Management*, *Organisation Science*, *Strategic Management Journal*, *Journal of Management Studies*, *Research Policy*, *Journal of Business Venturing*, *Organisation Studies*, *Strategic Entrepreneurship Journal, and Journal of Business Research*). To be inclusive in our search, we used a combination of the following stem keywords: ("digital" and "disrupt") or ("digital" and "transform"). To reduce the search string's length and avoid listing all alternative word forms, the truncation symbol (*) was applied. We searched two well-known electronic databases, Web of Science (WoS) and Scopus, to identify all relevant studies (Kohli & Melville, 2019).

Given our understanding of digital transformation as *emerging*, "always changing and adapting" (Bailey et al., 2022) we were interested in theoretical accounts of digital technology across multiple dimensions. Such accounts included not only an emphasis on the technology characteristics, but also on the ways by which different technologies afforded new business models, the organising of economic activity, and work practices. We used a bibliometric method (i.e., citation analysis) to identify a core corpus of DT studies (Zupic & Čater, 2015). Starting from the most cited papers in our core corpus we were able to begin to identify these dimensions across disciplines.

We then applied backward and forward searches on these highly cited papers (Webster & Watson, 2002) to uncover subsequent studies that helped build and sustain research trajectories around the identified dimensions. This additional analysis help us to uncover publications that did not include our stem keywords in our search. These included, among others, the ground breaking papers by Leonardi (2011) and Orlikowski and Scott (2008) on sociomateriality. Furthermore, to build our core corpus, we used citation data in the form of top-N lists of the most cited studies and journals to measure of influence (Zupic & Čater, 2015). Citation analysis as a science mapping technique reflects intellectual linkages between publications that are formed when one publication cites the other (Appio et al., 2014). We identified highly cited and most influential papers as the intellectual core. The details of these papers can be found in Table A1.

To clarify how we reached in-house and field assumptions, the first two authors carried out the initial coding of the core corpus and subsequent studies (following forward and backward citation analysis) to identify in-house and field assumptions (as presented in Table 1). As a first step, the first two authors checked each other's coding schemes to evaluate whether different papers were coded consistently. The coding scheme was based on many iterations of coding to gain a deep understanding of our data (Birks et al., 2013; Gerlach & Cenfetelli, 2020). This coding scheme was then subjected to scrutiny by the other two authors until theoretical saturation was reached. Theoretical saturation is achieved when there are no more instances of the codes in the data, and until there are no new conceptual categories or relations to be observed (Urquhart et al., 2010). All authors engaged in iterative discussions, by using data from the papers to reach consensus regarding the codes (in-house assumptions, field assumptions) and conceptual categories (research trajectories). Theoretical sampling with data from the papers and constant comparison and assessment of these codes and categories made it possible to arrive at theoretical saturation (Urquhart et al., 2010).

To provide more clarity on identification of research trajectories, we used the core corpus of highly cited papers. What distinguishes a research trajectory from a theme is that the former is a higher level of abstraction than the latter. For example, the research trajectory "digital technology architectures" incorporates themes on reprogrammability, generativity, open innovation, etc., and represents a tradition or school of thought (Alvesson & Sandberg, 2011). Each research trajectory has in-house assumptions that are unique (i.e., not shared with other trajectories) as well as field assumptions that are shared with other research trajectories. In the same way that we coded for in-house and field assumptions, we also coded for the aggregate level labels of the research trajectories. That is, the first two authors devised a coding scheme that the other two authors scrutinised. Essentially, following established qualitative analyses (Gioia, Corley, & Hamilton, 2013), we started with a text from our reviewed papers to derive in-vivo codes of digital transformation themes (e.g., generativity)—as seen in Table 2. Then, we iteratively

consolidated redundancies and gradually collapsed our in-vivo codes into first-order categories—that is, the in-house assumptions. We discussed any discrepancy in the interpretation, shifting back to data coding whenever necessary. Following this, we then progressed into second-order codes, reflecting a higher level of abstraction of our first order categories—that is, the field assumptions. Finally, we differentiated in-house assumptions into groups corresponding to higher-level aggregate themes that encompassed second order codes—that is, our research trajectories. We discussed and critically evaluated this coding scheme until we arrived at the five research trajectories that summarised our understanding of digital transformation across schools of thought. Details of the coding for our core corpus can be found in Table A2.

From this core corpus and their co-citation network of subsequent studies we identified five fundamental research trajectories, including a theoretical focus on *digital technology architectures*, *digital business models and new forms of value creation*, *new organisational forms enabled by digital technologies*, *digital technology affordances and the relationality of work practices*, and *the role of organisational identity, culture, and leadership in DT*. Table 1 summarises these trajectories that we discuss in more detail below.

2.3 | Research trajectory 1: Digital technology architectures

The first research trajectory focuses on digital technology architectures as the key to enabling DT within and across organisations. This delves into the underpinning architectural foundations of digital technology and their pivotal role in steering DT processes. It seeks to unravel the complexities of modular, agnostic technology structures, their generative potential, the transformative effects of data digitization, and the far-reaching implications of democratised innovation paradigms within and across organisations. This trajectory offers critical insights into the dynamic interplay between technology architectures and the evolving landscape of digital innovation.

This research trajectory builds on a set of in-house assumptions. First, it assumes that digital technology rests on layered and modular architectures that are agnostic to specific products, enabling them to be flexibly reused and reprogrammed across industries (Yoo et al., 2010). This adaptability fosters innovation and streamlines the development process, as common foundational elements form the backbone of numerous digital solutions. Secondly, this research trajectory assumes that digital technology is generative and can induce growth in modular components and users alike. This generativity allows modular components to evolve and diversify to meet a broad spectrum of needs, while users (including entrepreneurs) actively participate in creating and enhancing digital platform ecosystems (Fürstenau et al., 2023). Although, this dynamic interaction fosters continuous growth and adaptability within the digital realm, it also presents a challenge in terms of control and governance.

Another key assumption revolves around the digitization and homogenization of data (Yoo et al., 2010). Digital technology plays a vital role in transforming data into a format that is both digitised and homogenised, facilitating seamless access and sharing across different devices and networks (Tilson et al., 2010). This transformative capability ensures that data can be used efficiently and effectively by users and organisations alike, regardless of the specific devices or networks that they employ.

The final assumption highlights the influence of digital technology on innovation paradigms. It fosters open, distributed innovation across a spectrum of heterogeneous firms and third parties. While this democratisation of innovation is immensely empowering, it also blurs the traditional boundaries of organisations. It engenders collaborative ecosystems where multiple stakeholders contribute to and benefit from the innovation process. However, this democratisation also brings forth complex governance and control challenges, as digital technologies' ownership and direction become contested issues among diverse participants (De Reuver et al., 2018).

In summary, the four in-house assumptions underpinning the digital technology architecture focus on technology's modular and agnostic nature, its generative potential, the digitization and homogenization of data, and the democratisation of innovation.

TABLE 1 Key research trajectories and theoretical assumptions on DT.

Research trajectory	In-house assumptions	Field assumptions	Representative studies (Core Corpus & Subsequent Studies)
1. Digital technology architectures	• Digital technology is built on layered and modular architectures that are product agnostic (i.e., they are software-based and thus can be reused and reprogrammed on multiple products) and shared by heterogeneous firms. • Digital technology is generative in that it can induce growth in modular components and users. • Digital technology digitises and homogenises data to enable seamless access and sharing across devices and networks. • Digital technology enables open, distributed innovation across heterogeneous firms and third parties, but such innovation blurs organisational boundaries and raises tensions over who has control over the governance of digital technologies	• Technological modularity • Economies of scale and scope • Digitization of data • Innovation as distributed collective action	Yoo et al. (2010); Tiwana et al. (2010); Tilson et al. (2010); De Reuver et al. (2018); Henfridsson and Bygstad (2013); Fürstenau et al. (2023); Lehmann et al. (2022)
2. Digital business models and new forms of value creation	• Digital technology has changed the nature of competition from local to global and from physical products to digital services, intensifying rivalry even between companies that have not traditionally operated in similar markets. • Greater pressure by consumers for on-demand, personalised access to digital services through smart devices has changed processes of value co-creation. • Digitalization of business processes and digitization of data have generated cost efficiencies, and better customer experiences. • Digital technology has enabled new business models, including software-as-a-service that can generate economies of scale and scope.	• Technological modularity • Economies of scale and scope • Digitization of data	Bharadwaj et al. (2013); Matt et al. (2015); Barua et al. (2004); Verhoef et al. (2021); Loebbecke and Picot (2015); Chanias et al. (2019)
3. New organisational forms enabled by digital technologies	• Digital technology gives rise to platform ecosystems—a type of meta-organisation—whereby a hub firm provides a set of core components upon which third party complements can be added. • Ecosystem relationships depend on the co-specialisation of resources and capabilities of diverse firms (including startups) such that resource A depends on resource B for a core value proposition to emerge (e.g., smart energy meters & smart home apps). • Platform ecosystems enable open, distributed innovation across entrepreneurial networks and third parties but require a specific set of governance mechanisms to be sustainable.	• Technological modularity • Economies of scale and scope • Innovation as distributed collective action	Jacobides et al. (2018); Gawer (2014); Adner and Lieberman (2021); Kretschmer et al. (2022); Autio et al. (2018); Nambisan (2017); Nambisan et al. (2019)

(Continues)

TABLE 1 (Continued)

Research trajectory	In-house assumptions	Field assumptions	Representative studies (Core Corpus & Subsequent Studies)
4. Digital technology affordances and the relationality of work practices[a]	• Digital technology affords opportunities for action that can transform existing work practices. It is relational to those using it, including their political agendas and power struggles with other actors. • Digital technology affordances are also relational to the digitization of data. • Digital technology can help overcome organisational inertia, but also feed cycles of it.	• Relational affordances • Digitization of data • Organisational inertia	Orlikowski and Scott (2008); Leonardi (2011); Willems and Hafermalz (2021); Sergeeva et al. (2020); Lebovitz et al. (2021); Scott and Orlikowski (2022); Leonardi and Vaast (2017); Kallinikos et al. (2013); Alaimo and Kallinikos (2022)
5. The role of organisational identity, culture, and leadership in DT	• Core values, power distribution (e.g., between professions or business units) and control mechanisms within organisations shape processes of DT. • Organisational identity is both internally defined by senior management and embodied in the culture of work, but also externally reacted to by partners, customers, and other stakeholders. DT may be enabled if it aligns with organisational identity or resisted if it contests that identity. • Digital technology must be legitimised internally (against organisational capabilities and practices) and externally (against the capabilities of digital technology partners).	• Relational Affordances • Organisational inertia • Innovation as distributed collective action	Tripsas (2009); Lucas Jr and Goh (2009); Wessel, Baiyere, Ologeanu-Taddei, Cha, and Blegind-Jensen (2021); Thomas and Ritala (2022); Abouzahra et al. (2022); Lifshitz-Assaf (2018)

[a]We acknowledge that within this research trajectory studies adopt a "relational ontology" between technology and humans, albeit with some variations (e.g., 'soft' versus 'hard' sociomateriality—see Jones (Jones, 2014)).

TABLE 2 Processes for constructing theoretical contributions in DT research.

Process	Key rhetorical practices	Example quotes from representative studies (Core Corpus & Subsequent Studies)	Affiliated trajectories and assumptions
1. Synthesising knowledge	• Formulate general ideas by making thematic characterizations between diverse perspectives. • Construct congruent relationships by establishing connections between divergent literatures/ perspectives. • Demonstrate latent consensus by reinterpreting work.	*"Despite the importance of technological platforms, the management research agenda has been… dominated by two distinct theoretical perspectives: one inspired from economic theory, and the other from engineering design. These perspectives have developed separately and have conceptualised platforms either as types of markets …or as modular technological architectures…This article aims to bridge the dominant theoretical perspectives and proposes a unified theoretical framework for research on technological platforms…I demonstrate that there has been an undetected conceptual commonality between the two, namely that platforms create value through economies of scope in supply and/or in demand."* (Gawer, 2014, pp. 1239–1240) *"The notion of platforms refers to disparate things in marketing (product lines), software engineering (software families), economics (products and services that bring together groups of users in two-sided networks) …, information systems (infrastructural investments) …, and industrial organisation (forming systems) … Building on the synthesis by …. of the commonalities across these conceptualizations, we define a software- based platform as the extensible codebase of a software-based system that provides core functionality shared by the modules that interoperate with it and the inter-faces through which they interoperate"* (Tiwana et al., 2010, p. 675) *"IT strategies usually focus on the management of the IT infrastructure within a firm, with rather limited impact on driving innovations in business development… Digital transformation strategies take on a different perspective and pursue different goals. Coming from a business-centric perspective, these strategies focus on the transformation of products, processes, and organisational aspects owing to new technologies… "Independent of the industry or firm, digital transformation strategies have certain elements in common. These elements can be ascribed to four essential dimensions: use of technologies, changes in value creation, structural changes, and financial aspects."* (Matt et al., 2015, pp. 339–340)	Trajectory targeted: *New organisational forms enabled by digital technologies.* Assumptions targeted: *synthesising knowledge on assumptions about economies of scale and scope (field assumptions)* Trajectory targeted: *Digital technology architectures.* Assumptions targeted: *synthesising knowledge on assumptions about technological modularity (field assumptions)* Trajectory targeted: *Digital business models and new forms of value creation.* Assumptions targeted: *synthesising knowledge on assumptions about the nature of competition and value creation (in-house assumptions)*
2. Extending knowledge	• Construct cumulative progress by referencing time devoted to a topic area to underscore effort devoted to a domain.	*"Christensen's theory of disruptive technologies is one of the most popular for explaining the plight of the incumbent firm facing a significant new technology… Our first extension to Christensen is to emphasise the change process required to adopt a disruptive technology. Senior management has to convince others of the need to move in a new direction. Specifically, we are*	Trajectory targeted: *The role of organisational identity, culture, & leadership in DT.* Assumptions targeted: *extending knowledge on assumptions about*

(Continues)

TABLE 2 (Continued)

Process	Key rhetorical practices	Example quotes from representative studies (Core Corpus & Subsequent Studies)	Affiliated trajectories and assumptions
	• Uncover new research directions by indicating the existence of shared themes in the cumulative knowledge.	*interested in how middle managers change themselves and also bring about change in the organisation… [Secondly] We propose to extend this part of his theory to encompass the culture of the organisation, by which we mean the beliefs of employees, the way the firm organises itself and the nature of the interactions among employees…"* (Lucas Jr & Goh, 2009, p. 47) *"Business process management (BPM) research emphasises three important logics—modelling (process), infrastructural alignment (infrastructure) and procedural actor (agency) logics. These logics capture the dominant ways of thinking in BPM, reflected in its assumptions, practices and values. … Based on an ethnographic study of BPM in a company undergoing digital transformation, we uncover tensions related to applying these prior logics… We thus argue that digital transformation provides us with a unique opportunity to sharpen existing BPM logics and extend them beyond their theoretical limits. Therefore, the purpose of our paper is to unpack the implications of digital transformation for traditional BPM logics."* (Baiyere et al., 2020, pp. 238–239)	*the alignment between DT practices and organisational identity and core values (in-house assumptions)* Trajectory targeted: *Digital business models and new forms of value creation* Assumptions targeted: *extending knowledge on assumptions about how DT transform existing business models (in-house assumptions)*
3. Negating knowledge	• Construct discord among researchers by making contentious characterizations, negating findings, and dichotomizing approaches.	*"Recent research provides ample anecdotal and speculative evidence that Internet computing has spawned a wave of innovations in system development and services … and has changed computing into a global phenomenon that utilises global infrastructures .... These studies, although illuminating, do not formulate a theoretical model of how changes in information systems (IS) development and services depend on antecedent changes in technological capability, and what types of changes are necessary to establish a disruptive information technology (IT) innovation. In short, they identify neither necessary nor sufficient conditions for radical and widespread change in IS development and its outcomes. They also fail to provide empirical validation of the extent to which organisations deploying Internet technologies have experienced significant and lasting changes."* (Lyytinen & Rose, 2003, p. 558) *"In the management literature on algorithms in the workplace …, algorithms are discussed from a perspective of automation and augmentation perspective. … First, it is assumed that the work itself and what is required of it is something that can be 'known' such that algorithms can then automate or augment specific tasks. Second, implementing algorithms in the workplace is a matter of 'adding on' a technology to facilitate specific tasks or make them more*	Trajectory targeted: *Digital technology architectures.* Assumptions targeted: *negating knowledge on assumptions about distributed IT innovation (field assumptions)* Trajectory targeted: *Digital technology affordances and the relationality of work practices.* Assumptions targeted: *negating knowledge on assumptions about how digital technology can transform existing work practices (in-house assumptions)*

TABLE 2 (Continued)

Process	Key rhetorical practices	Example quotes from representative studies (Core Corpus & Subsequent Studies)	Affiliated trajectories and assumptions
		efficient. … These two assumptions do not align with the observations of algorithm scholars who take a more critical, performative point of view. … Algorithms …, transform what workers can know and what they can 'see' in their work practice. …These changes in the workplace do not occur because algorithms 'have' objective power, but because they, as Neyland and Mollers (2017) frame it, produce a particular distribution of knowledge between algorithmic technologies and professionals. In this paper we are concerned with understanding how algorithms transform work practices, with a specific focus on how knowledge and expertise become spatiotemporally distributed among a diverse set of people and technologies." (Willems & Hafermalz, 2021, p. 2)	
4. Filling incomplete knowledge	• Point out the shortcomings and discuss how the present research can address those. • Unearth opportunities for going beyond established knowledge boundaries	*"Clearly, a lot is at stake and our current understanding is limited—otherwise we would not see so many seemingly contradictory viewpoints, analyses, and political recommendations. This gap calls for extensive research in IS and neighbouring disciplines—ideally developing theories that will allow us to appropriately tackle the next technological wave. A better understanding of the underlying mechanisms and the effects of digitization and big data analytics allows us to systematically approach any resulting opportunities and challenges from an IS perspective."* (Loebbecke & Picot, 2015, p. 154) *"While some organisational research has begun focusing on how individual experts are perceiving and using AI-generated knowledge outputs in their daily work …, we know little about how modern AI tools are being evaluated for potential organisational adoption to begin with. In response to this growing need, this study investigates how managers form evaluations of ML-based AI tools in the context of making medical diagnoses, bringing to light the stifling challenges that arise and the consequences of their evaluation practices for AI adoption."* (Lebovitz et al., 2021, p. 1504) *"Information technologies (IT) constitute one of the most visible manifestations of change in contemporary society. Societal changes, including changes to social relations, economic interactions, and political processes, are increasingly entangled with IT. Recent work … has highlighted the rising interest in the role of IT as a source of both positive societal transformations and complex societal challenges. On the one hand, advances in IT are associated with opportunities for positive changes in societal conditions …. On the other hand, IT is linked to*	Trajectory targeted: *Digital business models and new forms of value creation.* Assumptions targeted: *filling incomplete knowledge on assumptions about how digital technology enable new business models (in-house assumptions)* Trajectory targeted: *Digital technology affordances and the relationality of work practices.* Assumptions targeted: *filling incomplete knowledge on assumptions about how digital technology can transform existing work practices (in-house assumptions)* Trajectory targeted: *The role of organisational identity, culture, & leadership in DT.* Assumptions targeted: *filling incomplete knowledge on assumptions about how digital*

(Continues)

TABLE 2 (Continued)

Process	Key rhetorical practices	Example quotes from representative studies (Core Corpus & Subsequent Studies)	Affiliated trajectories and assumptions
		a wide range of societal challenges …. Despite the increasing visibility and public attention to how IT matters at a societal level, theoretical developments that account for the complexity of the relationship remain limited." (Faik et al., 2020, pp. 1359–1360)	*technology need to be legitimised both internally and externally (in-house assumptions)*
5. Identifying oversights	• Illuminate oversights in our understanding by pointing out how an alternative perspective or combination of perspectives can redress those oversights.	*"The sparse attention to infrastructural issues … can be partially explained by … the weak theoretical understanding of digital infrastructure as a new type of IT artefact… we need to recognise pivotal differences that make digital infrastructures generative. These include its recursive nature, scalability, flexibility, and the varying substance of the material (data) being 'transported.'"* (Tilson et al., 2010, p. 752) *"Although our cumulative knowledge of the dynamics associated with identity is considerable, its specific relationship to technological change efforts remains neglected…. This study … enhances our understanding of why the pursuit of new technological opportunities can be so problematic…. Identity is not just one more factor to consider when unravelling sources of inertia. Identity serves as a guidepost, directing the development of some routines and capabilities over others and reinforcing some beliefs over others…"* (Tripsas, 2009, p. 442) *"While studies on digital innovation consider generativity to be a source of combinatorial innovation …, they often do not consider the environment in which digital ventures must operate. As a result, the literature creates an unrealistic expectation that digital ventures can—and should—pursue the generativity of digital technology however they see fit. …. Therefore, neglecting the environment into which digital ventures enter distorts our understanding of how generativity manifests and how it impacts value creation. To understand how digital ventures resolve this dilemma, we adopt a designing view. …. The designing view draws attention to the key tension that constitutes the dilemma that digital ventures face: As these ventures construct their offerings, should they focus on current environmental conditions or explore the use of generative digital technology that will address future needs?"* (Lehmann et al., 2022, p. 1454)	Trajectory targeted: *Digital technology architecture.* Assumptions targeted: *identifying oversights on assumptions about how digital technology digitises and homogenises data regardless of devices and networks (in-house assumptions)* Trajectory targeted: *The role of organisational identity, culture, & leadership in DT* Assumptions targeted: *identifying oversights on assumptions about how identity can accelerate or inhibit DT practices (in-house assumptions)* Trajectory targeted: *Digital technology architectures.* Assumptions targeted: *identifying oversights on assumptions about digital technology generativity (in-house assumptions)*

TABLE 2 (Continued)

Process	Key rhetorical practices	Example quotes from representative studies (Core Corpus & Subsequent Studies)	Affiliated trajectories and assumptions
6. Pointing at the incommensurability of our knowledge	• Advocate for an alternate thesis in understanding emergent phenomena by pointing at the incommensurability of our knowledge	*"Capturing the traditional view of organisation computing, … note, information systems are implemented within an organisation for the purpose of improving the effectiveness and efficiency of that organisation. An important implicit assumption here is that computing is seen as a separate activity that is carried out in order to accomplish other activities with higher goals. Such a view on computing makes it difficult to explore emerging computing phenomenon that is deeply entangled with everyday life experiences. Furthermore, such a view is often based on the idea that computing is "out there," separate from other forms of human activities. I argue that emerging computing phenomenon in everyday life is based on a different computing ontology… I further argue for an emerging domain of research within the IS community drawing on both the behavioural science and design science traditions in order to fill the current intellectual void. In order to do this, the notion of experiential computing is presented as a way of going forward."* (Yoo, 2010, p. 215)	Trajectory targeted: *Digital technology architectures*. Assumptions targeted: *pointing at incommensurability of our knowledge on assumptions about innovation as distributed collective action (field assumptions)*

2.4 | Research trajectory 2: Digital business models & new forms of value creation

The second research trajectory focuses on digital business models and their profound influence on the nature of competition. These models have redefined competition, transcending geographical boundaries and shifting the focus from traditional products to agile digital services. This transformation intensifies rivalry, prompting companies from diverse markets to adapt to this new global competitive landscape. The trajectory also highlights the evolving demands of consumers in the digital age. They seek to reshape traditional value creation approaches through personalised, on-demand access to digital services via smart devices. Moreover, digitalizing business processes and data digitization offers cost efficiencies and improved customer experiences. Put simply, this research trajectory emphasises how digital business models drive the shift from local to global competition, foster the demand for personalised digital services, enhance operational efficiency, and elevate customer experiences. These changes pave the way for innovative forms of value creation.

Given this focus, the first assumption made by studies in this research trajectory is that digital technology has changed the nature of competition. Digital technology has helped organisations transcend geographical boundaries and alter the traditional focus on physical products to a more dynamic digital services approach (Chanias et al., 2019). This shift has intensified rivalry, fostering competition even among companies that once occupied completely different markets. The lines between industries have blurred, so companies must adapt to a new paradigm of global competition.

The second assumption centres on the evolving demands of consumers, who now wield significant influence in the digital age. There exists a greater impetus for on-demand, personalised access to digital services through smart devices (Li & Tuunanen, 2022). DT's rising trend has profoundly influenced how consumers interact with products and services. With the rise of smart devices and the growing demand for improved personalised experiences, traditional value creation paradigms have evolved significantly (Hein et al., 2019). This dynamic shift in focus on the end user experience has reshaped how value is created with end consumers as active participants.

The third assumption stresses the remarkable benefits derived from the digitalization of business processes and the digitization of data. On the one hand, this transformation has yielded substantial cost efficiencies, enabling companies to optimise their operations and resources (Loebbecke & Picot, 2015). On the other hand, customers enjoy enhanced experiences, thanks to the wealth of data-driven insights that inform businesses' decisions and actions.

Last but not least, the fourth in-house assumption held in this trajectory recognises the role of digital technology in catalysing novel business models such as the rise of Software-as-a-Service (SaaS). The emergence and growth of software as a service (SaaS) has fundamentally changed the way software can be delivered, used, and managed. SaaS represents a new software delivery and pricing model, in which the vendor hosts, maintains, and manages the application from a central location; serves clients over a network; and charges based on usage (Guo & Dan, 2018). Such innovative models disrupt traditional industry structures while creating opportunities for economies of scale and scope.

In conclusion, these four in-house assumptions collectively illuminate how the research trajectory on new business models focus on the shift from local to global competition, the demand for personalised digital services, the cost efficiencies and improved customer experience achieved through digitalization, and the emergence of innovative business models for economies of scale and scope, all of which generate new forms of value creation.

2.5 | Research trajectory 3: New Organisational forms enabled by digital technology

This research trajectory focuses on the paradigm-shifting impact of digital technologies on how economic activities are organised. While previously, organisations would rely on hierarchical integration of resources and capabilities to serve their customers, they now provide foundational components, which serve as the building blocks for seamless integration of third-party specialised solutions on digital platform ecosystems (Constantinides et al., 2018; Jacobides et al., 2018).

This research trajectory holds a strong in-house assumption that digital technology heralds the emergence of digital platform ecosystems that revolutionise industries and challenge conventional business paradigms. These ecosystems represent a unique form of meta-organisation in which a central hub firm lays the foundation by providing core components (Kretschmer et al., 2022) that serve as building blocks upon which third-party complements can be seamlessly integrated (Jacobides et al., 2018). The result is a collaborative ecosystem that transcends traditional industry boundaries and enables new entrepreneurial networks (Autio et al., 2018). Hub firms act as enablers of value creation, while third-parties contribute diverse and specialised solutions (Adner, 2021).

Another in-house assumption is the role of resources and capabilities within digital ecosystems. Ecosystem relationships depend on the co-specialisation of these resources among diverse firms (Brueller & Capron, 2021). A key insight is that one firm's value proposition often hinges on another's complementarity. This co-dependence underscores the intricate web of digital ecosystems, where companies from various backgrounds must collaborate to deliver holistic and compelling solutions (Adner & Lieberman, 2021). An illustrative example lies in the synergy between firms providing smart energy meters and smart home apps, where the value is amplified through co-specialisation.

The third assumption revolves around the extraordinary potential of platform ecosystems to foster open and distributed innovation. These ecosystems serve as fertile ground for many heterogeneous firms and third parties to come together in pursuit of progress (Gawer, 2014). However, sustaining such ecosystems requires specific governance mechanisms. These environments' inherent openness and decentralisation require a delicate balance between collaboration and control. Effective governance structures must be in place to nurture cooperation, incentivise contributions, and ensure equitable resource allocation (Chen et al., 2021). Achieving this balance is crucial for the long-term sustainability of platform ecosystems (Chen et al., 2022).

2.6 | Research trajectory 4: Digital technology affordances and the relationality of work practices

The fourth research trajectory focuses on the transformative potential of digital technology in reshaping work practices within organisations. This trajectory highlights that digital technology does not impose change by default; instead, its impact varies based on how individuals utilise it, their abilities, and the context of their work practices. Moreover, this research trajectory emphasises that the influence of digital technology extends to the construction and accessibility of data, underscoring the significant role data plays in DT.

A key in-house assumption of this research trajectory focuses on how digital technology affords opportunities for action that can transform existing work practices (Leonardi, 2011; Leonardi & Vaast, 2017; Sergeeva et al., 2020). Digital technology does not transform organisations by default; rather, individual workers within organisations will use technologies differently, according to their own abilities, the constraints in their work practices, and their existing professional boundaries and interpersonal relationships. This is particularly true of algorithmic technologies, such as AI-enabled diagnostic tools that are meant to automate or augment existing work practices, while in reality they become contested or used with bricolage by professionals (Lebovitz et al., 2021; Willems & Hafermalz, 2021).

A second assumption is that the affordances of digital technology are also relational to how data are constructed and made available for use by different actors. Data are not given, but rather co-constituted in institutional and technological practices, including policies for data access and sharing, but also design decisions around data labelling and learning processes that feed into algorithmic technologies (Monteiro & Parmiggiani, 2019). As such, data is an important asset in DT, but it also shapes how such transformation occures.

Finally, another key assumption of this research trajectory is that digital technology is not only a force for DT, but also of organisational inertia. Not only does digital technology create waves of digitization that generate new business models and forms of value creation, it also creates "corollary effects" that displace current work practices

(Scott & Orlikowski, 2022). Such displacement undermines the very process of DT as it causes organisational actors to rethink the purpose and use of digital technology vis-à-vis current work practices.

In summary, these three in-house assumptions collectively underscore a critical (and performative) understanding of DT, in contrast to the previous trajectories.

2.7 | Research trajectory 5: The role of organisational identity, culture, & leadership in DT

This research trajectory emphasises the profound influence of organisational identity, culture, and leadership in DT programs. This trajectory sees an organisation's core values, power dynamics, and control mechanisms as integral pieces of a big puzzle that organisations need for effectively utilise digital technologies. This trajectory underscores the substantial role of organisational identity, rooted in senior management's vision, deeply ingrained in the company's cultural fabric, and how it significantly impacts DT endeavours.

The first in-house assumption emphasises on organisational identity, internally defined by senior management and embedded in the company's culture, and its undeniable role in DT (Wessel, Baiyere, Ologeanu-Taddei, Cha, & Jensen, 2021). Identity broadly represents the organisation's purpose, value proposition, and its values concerning its employees, customers, and broader ecosystem stakeholders (e.g., commitment to green values, open-source software etc.). As such, identity is also externally defined by partners, customers, and other stakeholders, who come to recognise the organisation as belonging to an organisational category (Tripsas, 2009). Organisational identity acts as a guiding force that can either facilitate or hinder DT efforts. When identity is aligned with the changes wrought by digital technologies, it can inspire employees and drive innovation. Conversely, resistance can arise when DT challenges or contradicts this identity (Kane et al., 2019; Lucas Jr & Goh, 2009). These internal dynamics wield considerable influence over how organisations navigate the digital landscape (Tripsas, 2009; Wessel, Baiyere, Ologeanu-Taddei, Cha, & Jensen, 2021).

Another key in-house assumption is that digital technology must be legitimised to remove any uncertainty around its intended use (Dahabiyeh & Constantinides, 2022; Faik et al., 2020). First, it must be legitimised internally, aligning with the existing capabilities, organisational routines, and the organisation's cultural values (Lucas Jr & Goh, 2009). Second, digital technology must be legitimised externally, particularly when it involves partnerships with digital technology providers. Building trust and credibility in the broader digital ecosystem is essential to the success of DT initiatives (Thomas & Ritala, 2022).

Finally, this research trajectory assumes that inertia is created within organisations as a consequence of legacy systems, organisational routines and mindsets that pose significant obstacles to DT. Identity, culture and leadership form the "deep structure" of organisations that is very difficult to change, often requiring long-term organisational transformation (Besson & Rowe, 2012; Heracleous & Barrett, 2001).

3 | CONSTRUCTING THEORETICAL CONTRIBUTIONS IN DT RESEARCH

Having identified the aforementioned research trajectories on DT, including their in-house and field assumptions, the next step in our problematization review was to examine how individual studies within these trajectories position themselves against earlier research to construct theoretical contributions. We draw on Locke and Golden-Biddle's (1997) problematization method to understand how DT researchers contribute to knowledge. We identify six processes including *synthesising*, *extending*, and *negating* extant knowledge, but also *identifying oversights*, *filling incomplete knowledge*, and *pointing at the incommensurability of our knowledge*. These processes are summarised in Table 2 with examples from representative studies. We do not differentiate which of these processes are utilised in each research trajectory, because we find that researchers across these trajectories use the same processes. We discuss these below in more detail.

3.1 | Synthesising knowledge

A first process of constructing theoretical contributions is the synthesis of prior knowledge. Several papers in our review emphasise the importance of paying attention at the commonalities between perspectives—and identifying where each perspective offers unique insights—to enable a deeper theorization of the DT under focus. Both the strategic management and IS literatures highlight the benefits of integrating insights from diverse disciplines and perspectives (Hanelt et al., 2021; Verhoef et al., 2021; Vial, 2019).

The process of synthesising knowledge leverages rhetorical practices such as, formulating general ideas by making thematic characterizations between diverse perspectives; constructing congruent relationships by establishing connections between divergent literatures or perspectives; and demonstrating a latent consensus by reinterpreting current work on a particular topic (Locke & Golden-Biddle, 1997). For instance, to conceptualise the evolution of digital infrastructure, Henfridsson and Bygstad (2013) highlight the distinct thematic characterizations of digital infrastructure from different perspectives, namely, positivism and interpretivism. They argue (Henfridsson & Bygstad, 2013, p. 908):

> "Covering the two main philosophical traditions in IS research, typically referred to as positivism and interpretivism, extant infrastructure research displays slightly different foci. It tends to be occupied with either situated contexts of practice, or directly observable managerial aspects. Adhering to interpretivism, considerable attention has been paid to the evolution of digital infrastructure as it plays out in the complex interdependencies between socio-technical elements (Braa et al. 2007); networks of human and nonhuman actors; and the relationships between organized practices. In studies underpinned by positivist assumptions, the research has primarily dealt with strategic IT portfolio management and the alignment of IT imperatives with business strategy."

The authors then propose critical realism as a way to bridge interpretivism and positivism, while also offering new insights into the generative mechanisms of digital infrastructure evolution (Henfridsson & Bygstad, 2013). By reinterpreting extant research on digital infrastructure through the lens of critical realism, the authors point at opportunities for a latent consensus. Henfridsson and Bygstad (2013) target the first research trajectory—*digital technology architectures*- by synthesising knowledge on assumptions about the generativity of digital technology (*in-house assumptions*).

Similarly, Hinings et al. (2018) point to how we can explain the combined effects of DT without necessarily seeking insights from new theories. They argue that, while many scholars have called for a multiplicity of perspectives to understand new digital technologies, there is a latent consensus about how we have always theorised change and innovation, digital or otherwise; such a latent consensus can be understood through the lens of institutional theory. This study targets the third research trajectory—*new organisational forms enabled by digital technologies*- by synthesising knowledge on assumptions about rise of platform ecosystems (*in-house assumptions*).

In summary, synthesising knowledge from various disciplines underscores the value of multidimensional exploration. It provides researchers a toolkit for unravelling the complexities of DT without being constrained to a single lens.

3.2 | Extending knowledge

Whereas the first process is about the breadth of our knowledge on DT across perspectives, this second process is about the depth of our knowledge within specific knowledge traditions and disciplines. It is about paying attention to the cumulative knowledge and assumptions within a knowledge domain in order to uncover new research opportunities. In particular, studies that employ the process of knowledge extension use key rhetorical practices such as constructing a cumulative progress by referencing the time devoted to a topic area to underscore the effort devoted

to a domain; and uncovering new research directions by pointing to the existence of common themes in the cumulative knowledge (Locke & Golden-Biddle, 1997). For example, Bharadwaj et al. (2013) start their introduction by highlighting the progressive use of such constructs as IT strategy, business strategy, and IT alignment in extant research, thus, pointing at cumulative knowledge and congruency within a community of IS researchers. Then they convincingly argue that advancement in digital technologies is fundamentally reshaping business conditions and boundaries, so it is time to move beyond the alignment view and rethink the position of IT strategy which is intertwined with every aspect of business strategy. Specifically they argue (Bharadwaj et al., 2013, p. 472):

> "This working definition highlights (1) going beyond the traditional view, thinking of IT strategy as a function within firms and recognizing the pervasiveness of digital resources in other functional areas such as operations, purchasing, supply chain, and marketing; (2) going beyond systems and technologies, which might have narrowed the traditional views of IT strategy to recognize digital resources, thereby being in line with the resource-based view of strategy…"

Then, they propose a set of new research themes that future studies should pay attention to, including (1) the scope of digital business strategy, (2) the scale of digital business strategy, (3) the speed of digital business strategy, and (4) the sources of business value creation and capture in digital business strategy. This study falls under the second research trajectory, which focuses on *digital business models and new forms of value creation*. It seeks to expand our understanding of assumptions related to the nature of competition and value creation (*in-house assumptions*).

Similarly, Agarwal et al. (2010) review existing studies on healthcare information technology (HIT) to establish how research has progressed over the years while focusing on two themes, "*the impact of HIT on health-care performance and issues related to HIT adoption.*" (Agarwal et al., 2010, p. 797). The authors then point at new "*consequential research opportunities … for IS researchers to leverage existing IS research domains and craft new ones*" (Agarwal et al., 2010, p. 799). These include research on HIT design, implementation, and "meaningful use"; measuring and quantifying of HIT payoff and impact; and extending the traditional domain of HIT by focusing on the patient's perspective, the internet and health and quality transparency and competition. This study is not necessarily confined to a specific research trajectory as it includes an extensive research agenda for developing digital technology and its application in healthcare. However, authors intend to extend current knowledge revolving around assumptions related to digitization of data as well as economies of scale and scope (*field assumptions*).

Thus, extending knowledge helps to go deeper in our understanding of a research domain, while building on the cumulative tradition.

3.3 | Negating knowledge

While previous processes concentrated on expanding and leveraging accumulated knowledge, this process advocates for the negation of current knowledge paradigms and pushes scholars to explore new theoretical perspectives. It contends that, DT requires scrutinising existing theoretical assumptions to build more suitable perspectives (Gkeredakis & Constantinides, 2019). In particular, studies employing the process of negating knowledge utilised the key rhetorical practice of constructing discord among researchers on a topic area, by pointing at the contentious characterizations made by different studies, negating their findings and dichotomizing approaches (Locke & Golden-Biddle, 1997). For example, as shown in Table 1, Lyytinen and Rose (2003) construct discord in the context of disruptive innovation. The initial sentence highlights the importance of internet computing, but the text then explicitly points out how extant literature understands this domain in contentious terms (Lyytinen & Rose, 2003, p. 558). They go on to negate prior findings using phrases like *"they identify neither necessary nor sufficient conditions"*, and *"They also fail to provide empirical validation"* (Lyytinen & Rose, 2003, p. 558). This study points at *digital technology*

architectures as the research trajectory and focuses on negating knowledge on assumptions about distributed IT innovation (*field assumptions*).

Similar to Lyytinen and Rose (2003), Nambisan (2017, p. 1030) seeks to negate earlier findings by pointing out the shortcomings:

> "Despite its contemporary significance, however, existing research in entrepreneurship has largely neglected the role of digital technologies in entrepreneurial pursuits. Prior research on technology entrepreneurship has by and large focused on entrepreneurship as practiced in technology-intensive environments (including digital technology), wherein technology is treated merely as a context for empirical work. Limited effort has been made on theorizing the role of specific aspects of digital technologies in shaping entrepreneurial opportunities, decisions, actions, and outcomes."

The paper focuses on the first research trajectory, *new organisational forms enabled by digital technologies*, as a means to challenge existing knowledge and guide researchers toward exploring fresh theoretical perspectives.

Other studies in our review used less controversial rhetorical strategies, although equally negating knowledge in their target literatures. For example, Willems and Hafermalz (2021) first highlight some core assumptions of earlier work on automation and augmentation to then present a more critical perspective, one that rejects the "objective power" of algorithms and rather focuses on their "performative" role, following a new and emerging body of research. In this context, the authors address the fourth research trajectory, which revolves around *digital technology affordances and the relationality of work practices*. Their goal is to challenge existing knowledge regarding how digital technology can reshape established work practices (*in-house assumptions*).Other studies have also cautioned against the unproblematic treatment of digital technology, especially the view of unbounded growth and increased value creation that is largely dominant in research on DT; these studies, call instead for a historical understanding of the sociotechnical practices that feed into cycles of DT (Bailey et al., 2022; Scott & Orlikowski, 2022).

3.4 | Filling incomplete knowledge

This process serves as a powerful catalyst for filling incomplete knowledge in our understanding of DT. In particular, studies that employ the process of filling incomplete knowledge employ rhetorical practices such as, pointing at the shortcomings of existing research and discussing how the present research can address those; and by unearthing opportunities for going beyond established knowledge boundaries within a topic area (Locke & Golden-Biddle, 1997). For instance, in their introduction, Autio et al. (2018) identify a research gap in the literature around entrepreneurial ecosystems:

> "Broadly characterizing, the economic geography tradition has sought to understand economic … rationales that might explain regional agglomeration patterns of businesses and industries … However, although some work in these traditions assigns entrepreneurs a significant role, none of the previous frameworks have treated entrepreneurial opportunity pursuit as the defining aspect of the cluster dynamic."

Note how the mentioned excerpt exhibits the research gap by citing several studies from different research traditions. Then, the authors continue by articulating how they will fill the identified gap (Autio et al., 2018, p. 74):

> "We build a conceptual model of entrepreneurial ecosystems as a distinct type of cluster that specializes in harnessing technological affordances created by digital technologies and infrastructures … and

> combines them with spatial … affordances to support a distinctive cluster dynamic that is expressed through the creation and scale-up of new ventures."

The above-mentioned excerpts clarify that authors mainly target the research trajectory, *new organisational forms enabled by digital technologies*, by filling incomplete knowledge on assumptions about how platform ecosystem enable distributed innovation across entrepreneurial networks (*in-house assumptions*).

In another example, Warner & Wäger, 2019 argue that despite the proliferation of research on DT, "the building of capabilities for DT has received limited scholarly attention and is now an essential context for the study of strategic change." The authors situate their work within the strategy literature, while simultaneously pointing at the research gap (Warner & Wäger, 2019, pp. 326–327):

> "… 'digital transformation is fundamentally not about technology, but about strategy,' meaning that senior leadership teams must find ways to capitalize on new and unexpected business model innovations… However, …there is scant research that examines how organizations build dynamic capabilities for digital transformation."

Then, the authors articulate their main research question and explain how they will use multiple case studies of incumbent firms' DT. Through such an empirical examination, the authors claim to fill the research gap and contribute to the literature in two different ways. They not only conceptualise and define the scope of the DT but also provide empirical insights into what types of digitally based dynamic capabilities might be required for DT (Warner and Wäger, 2019). This study fits within the second research trajectory, *digital business models and new forms of value creation*, while filling incomplete knowledge on assumptions about how digital technology has changed the nature of competition (*in-house assumptions*).

3.5 | Identifying oversights

This fifth process calls for a need to identify oversight. As the book by Kane et al. (2019) provocatively puts it, there is a "technology fallacy" in our understanding of DT. While research tends to place emphasis on technology, we tend to overlook the role that people play in DT (Tripsas, 2009). Studies in our review that identified oversights in prior research used rhetorical practices to point out how different perspectives and/or frameworks can create unrivalled opportunities for making novel contributions (Locke & Golden-Biddle, 1997).

For instance, Lehmann et al. (2022) point at the oversight of previous research in understanding the context of digital ventures as a mediator for theorising the generativity of combinatorial innovation. To address this oversight they adopt a "design view" that "draws attention to the key tension that constitutes the dilemma that digital ventures face": the focus "on current environmental conditions or… the use of generative digital technology" to address the emergent needs of the venture (Lehmann et al., 2022). Here, authors build their arguments along the lines of the first research trajectory, *digital technology architectures*, by highlighting oversights in assumptions related to digital technology generativity (*in-house assumptions*).

Other examples include Tripsas (2009) who stresses the extant literature's inadequacy in understanding the role of identity in theories of technological change, before presenting her perspective and how it applies in a longitudinal empirical case. As mentioned in Table 2 this one targets the fifth trajectory, *the role of organisational identity, culture, & leadership in DT*, by identifying oversights on assumptions about how identity can accelerate or inhibit DT practices *(in-house assumptions)*.

Also, Sergeeva et al. (2020) highlight an oversight of past research in paying attention to the sensory facilities of professional workers as they perform their work, and how these sensory facilities become mediated by technology. They propose an embodiment perspective to understand how coordination within professional teams occures with

new digital technology such as robots. In this context, authors argue around the research trajectory, *digital technology affordances and the relationality of work practices*, highlighting oversights in assumptions about how digital technologies provide a context and opportunity for transforming work practices *(in-house assumptions)*.

3.6 | Pointing at the incommensurability of our knowledge

Finally, some studies in our review have pointed out that emergent digital technologies give rise to the "incommensurability thesis" (Kuhn, 2012), whereby theories from different time periods suffer from a deep failure of comparability. Thus, new studies into emergent digital technologies may be mistakenly assessed against paradigmatic theories of the past when they obviously do not fit these paradigms. For example, Yoo's (2010) commentary on experiential computing highlights that the IS community could not effectively study new digital technologies as the boundary between life and work have blurred, so it is difficult to separate organisational computing from personal activities. Recent technological developments in machine learning and big data analytics have accelerated experiential computing by penetrating many aspects of our daily lives. The point is that technological advances such as Open AI's ChatGPT shape not only the way we work, but also the way we live. We have entered a new revolutionary paradigm of DT that requires a deeper understanding of emerging technologies and their impact on organisations, but also on individuals and the social systems we live in (Alaimo & Kallinikos, 2022; Möhlmann et al., 2021; Zuboff, 2019).

Studies employing this last process utilise rhetorical practices to point out that there are misguided perspectives, that perspectives are moving in the wrong direction, or that current research cannot capture emerging digital technologies with current knowledge (Locke & Golden-Biddle, 1997). For instance, Grover and Lyytinen (2023) have argued that "Given the recent tidal wave of digital phenomena, scholars across management fields have started to question, debate, and defend the validity of their field's received theorizing". The authors argue for alternative "embedded" constructs for theorising these new phenomena." (Grover & Lyytinen, 2023, p. 46). Similarly, Baiyere et al. (2023) call for further research that would justify the "context shifts" of digital phenomena (e.g., where agency lies) and demonstrate the "qualified difference" of digital phenomena versus other phenomena (e.g., conceptual merit, empirical insight, or practical value). These studies do not target any specific research trajectories. Instead, they attempt to expand the research horizons and push the boundaries forward by challenging the field assumptions.

4 | DISCUSSION AND IMPLICATIONS: MOBILISING OUR FRONTIERS

Our problematization review of research on DT has identified key research trajectories and how different studies construct theoretical contributions. By reflecting on this review, it becomes evident that most research tends to stay within the boundaries of their ascribed research trajectory's in-house assumptions. As such, most studies will employ processes of constructing theoretical contributions that help them develop incremental insights to the cumulative growth of knowledge within a research trajectory. Challenging field assumptions is more difficult than doing the same for in-house assumptions because the former are shared across schools of thought and rarely critiqued (Alvesson & Sandberg, 2011). While we acknowledge that not all research should (and can) be path-creating, we argue that we need to break the mould of established research trajectories if we are to mobilise entirely new research trajectories. To do so, we need to focus less on in-house assumptions and more on field assumptions. More recent research on digital transformation has called for a need to challenge field assumptions, as discussed in the previous section (Grover & Lyytinen, 2023, p. 46). In this section, we attempt to go a step further by formulating specific questions for mobilising new frontiers in DT research.

In this section, we discuss the six field assumptions identified in our review that cut across research on DT to propose new field research questions. We mobilise new frontiers in DT research by reflecting on what we have

learned from our problematization review and establishing links with emerging research that challenges underlying field assumptions. Table 3 summarises our discussion.

4.1 | When is technological modularity generative?

Technological modularity was introduced as early as the 1960s (Parnas, 1972; Simon, 1996) and has since been adopted as a field assumption by different research trajectories within our review to explain generative growth, both in terms of architectural recombination (Yoo et al., 2010) and positive network externalities (Schilling, 2000). A modular architecture can reduce technological complexity by being decomposable into subcomponents, while stimulating generativity and open innovation (Cennamo et al., 2018; Eaton et al., 2015; Ghazawneh & Henfridsson, 2013; Henfridsson et al., 2018). Certainly, modularity can rest on both loosely coupled and tightly coupled interfaces, depending on whether the firm relies on proprietary or open-source components (e.g., Apple iOS vs. Google Android), and it can also be architected across multi-layered interfaces with varied links between different types of components (Um et al., 2022). These varied architectural configurations will generate distinct possibilities for growth and scale, but the field assumption still holds true.

Yet, more recent technological developments, especially around decentralised blockchain platforms challenge our understanding of generativity vis-à-vis technological modularity. While decentralised blockchain platforms are still modular and layered by design, their generative growth is very much dependent on changes in the source code often referred to as "forks". There are three kinds of forks: "the *pseudo-fork*, which repurposes existing source code and therefore has no compatibility issues, *development forks*, which are forward-incompatible insofar as they build capabilities that add to the code in the existing ledger, and the *hard fork*, which creates a fork that is either forward- or both forward- and backward-incompatible" (Andersen & Bogusz, 2019, p. 1249). In other words, pseudo- and development forks allow for the generative growth of decentralised blockchain platforms without challenging or requiring changes to the existing infrastructure. In contrast, hard forks involve fundamental changes to the underlying code and the infrastructure such that the immutable record of the distributed ledger and all its temporal reference points are broken. Accordingly, any smart contracts developed as complements to the underlying infrastructure of the blockchain platform (Halaburda et al., 2023) can no longer be executed.

Thus, this new type of digital infrastructure upon which blockchain platforms are built challenge current conceptualizations of modularity. With every hard fork, a new architecture must be built and new governance rules negotiated, as the latest version of Ethereum shows. Thus, generativity is limited, not only by the dynamic interaction between product (i.e., complements) and user growth (Fürstenau et al., 2023), but also dependent on whether the digital technology architecture grows by means of forward- and backward-(in)compatible modularity. Further research needs to examine when technological modularity is generative, but also when it becomes bounded.

4.2 | How do emerging digital technologies generate new forms of network economies?

Current DT research that focuses on new business models and organisational forms such as digital platform ecosystems assumes that, while new technologies require high up-front investment and fixed costs, these costs are often coupled with low or near-zero marginal costs of additional users (i.e., they create economies of scale). Digital technologies can also reduce costs and improve the service quality by operating simultaneously across multiple adjacent markets (i.e., they create economies of scope) (Bharadwaj et al., 2013; Kretschmer et al., 2022; Verhoef et al., 2021). These network externalities create the ability for some firms to achieve winner-take-all markets, becoming dominant (Rietveld & Schilling, 2021).

TABLE 3 Mobilising new frontiers in DT research.

Field assumption	Field research questions
1. Technological Modularity *The more modular a technological architecture, the more generative its growth (easier to interconnect with other modules produced by third parties through standardised interfaces)*	• *When is technological modularity generative?* For example, decentralised blockchain platforms scale through hard forks that are backward incompatible with previous versions of the technology architecture. Any modular components need to be built anew for the new version. Although decentralised blockchain platforms can scale in such a context, their generativity is bounded to their technology architecture.
2. Economies of Scale and Scope *The high up-front investment and fixed costs of developing a digital technology are coupled with low or near-zero marginal costs of additional users (economies of scale). Digital technologies can also reduce costs and improve the service quality by operating simultaneously across multiple adjacent markets (economies of scope)*	• *How do emerging digital technologies generate new forms of network economies?* For example, generative AI technologies with the ability to be integrated with existing digital platforms (e.g., Microsoft CoPilot integrated with Azure) can generate *economies of learning* that leverage data from heterogeneous organisations that already benefit from existing digital offerings.
3. Innovation as distributed collective action *While digital technology opens up the boundaries of innovation across heterogeneous actors, there are tensions over how such innovation is governed in relation to how value is appropriated and by whom*	• *How do we organise distributed innovation with algorithmic technologies?* As organisations become diffused across global boundaries, decentralised across thousands of network nodes and heterogeneous actors, collective action becomes too large to achieve through hierarchical control. Decentralised autonomous organisations that coordinate collective action through algorithmic routines, as opposed to hierarchical human routines, challenge how we organise for distributed innovation.
4. Digitization of data *Data are not simply turned into zeros and ones, data have become core resources with which to co-create DT*	• *When do data become valuable and with what consequences?* Data are used by both organisations that orchestrate algorithmic technologies and end users that depend on that data to do their work and carry on with their lives. Data are not ready to hand. Data are constructed through actual and synthetic activities to serve particular purposes at specific points in time. Data can be used to accelerate drug discovery at one point in time but could also end up designing chemical weapons at another time frame. Data are both a medium for action and a resource asset, both a driver and an outcome of DT.
5. Relational Affordances *Digital technology has certain properties or capabilities but those afford different possibilities of action based on the context of use*	• *What Possibilities of Action Can We Perceive?* Sociotechnical perspectives in IS research and recent DT studies emphasise technology's contextual capabilities. The interaction between human and artificial actors influences our understanding of possibilities and extends beyond contextual use, challenging researchers to explore the genealogy of actions, including technology's design and training. To understand this complex interplay, researchers must delve into the intricate dynamics of technology mediation and human-agent interaction. By analysing how technology shapes perceptions and influences decision-making, we can better grasp the multifaceted nature of relational affordances in the digital era.
6. Organisational inertia *DT requires organisational changes that are often resisted by organisational members because of misalignments with the organisational identity, culture, and leadership.*	• *Where is inertia and transformation constituted?* Given all the aforementioned field assumptions, DT is by nature unbounded; it is not contained within organisational boundaries. As such, identity, culture, and leadership need to transcend their organisational connotations across ecosystems of heterogeneous actors. This will be especially relevant for research on digital entrepreneurship that seeks to understand inertia and transformation across multiple and distributed sites of action.

While no one can deny the presence of economies of scale and scope, including the network effects they generate for both the demand and supply sides of a given market, new emerging digital technologies such as the recent wave of generative AI are generating new forms of network economies. These generative AI technologies such as GitHub's CoPilot leverage architectural innovations and a massive variety and volume of data to learn about associations and use them to generate new synthetic content that can increase the productivity of software developers by comparing learning within a community (Dohmke et al., 2023). These generative AI technologies can also be integrated with existing digital platforms (e.g., Microsoft CoPilot integrated with Azure) to create *economies of learning* that leverage data from heterogeneous organisations that already benefit from existing digital offerings.

Such economies of learning present both opportunities for growth and risks of knowledge appropriation. On the one hand, organisations can benefit from knowledge gained elsewhere to feed internal learning processes and, thus, augment DT efforts. For example, studies have found that generative AI technologies "capture the potentially tacit knowledge embodied in… the highest-skilled or most experienced workers" and disseminate it to low-skill workers who can benefit by incorporating such knowledge in their own work (Brynjolfsson et al., 2023, p. 2). On the other hand, more dominant organisations can exclusively control how such generative AI technologies learn, thereby creating standards upon which less resourceful organisations must conform. Many antitrust investigations have focused on the anticompetitive practices of dominant organisations on third parties, because of their dual role as producers and orchestrators of generative AI solutions (Hacker et al., 2023). Further research is needed that examines how emerging digital technologies generate new forms of network economies, and what the implications are for how knowledge is appropriated and for whom.

4.3 | How do we organise distributed innovation with algorithmic technologies?

Following the above discussion, a third field assumption focuses on the ways in which digital technology opens up innovation across heterogeneous actors beyond firm boundaries and vertical integration. This field assumption goes back to the work of Eric von Hippel and Henry Chesbrough with the former arguing for user-led innovation, focusing primarily on social or crowd-based production (also reflected in Yochai Benkler's work on commons-based peer production), and the latter arguing for open innovation through alliances with third-party complementors. While open or peer distributed innovation offers an alternative to the organisation of economic activity through hierarchical forms and has generated new research into platform ecosystems, as recent research has shown, there are tensions over how such innovation is governed in relation to how value is appropriated and by whom (Cennamo & Santaló, 2019; Chen et al., 2022). These tensions arise because innovation—despite its open premise—relies on centralised organisational forms with 'benevolent dictators' who control how innovation takes place.

Research has argued that as organisations become distributed across global boundaries and decentralised across thousands of network nodes and heterogeneous actors, collective action becomes too large to achieve through hierarchical control. Decentralised autonomous organisations that coordinate collective action through algorithmic routines, as opposed to hierarchical human routines, challenge how we organise for distributed innovation (Vergne, 2020). Decentralised autonomous organisations such as MakerDAO, which operates a digital platform by providing disintermediated financial services, with decisions made by members who buy tokens that grant them voting rights (Ellinger et al., 2023), remove the manager- or shareholder-centric control over innovation. Instead, control over how distributed innovation takes place is software-based, built into algorithmic mechanisms that enable alternative forms of value creation and appropriation, including the value of learning to innovate for the social good (Ellinger et al., 2023). Further research needs to explore how distributed innovation can be organised with algorithmic technologies away from centralised control, while paying attention at alternative forms of value creation and appropriation.

4.4 | When do data become valuable and with what consequences?

Research in our review has emphasised the impact of data digitization on DT (Bharadwaj et al., 2013; Hanelt et al., 2021; Verhoef et al., 2021; Yoo et al., 2010). Through big data analytics, data are not simply turned into zeros and ones, rather they become core assets with which to co-create DT. Data are used by both organisations that orchestrate algorithmic technologies and end users that depend on that data to do their work and carry on with their lives.

However, data are not ready to hand. Data are constructed through actual and synthetic activities to serve particular purposes at specific points in time (Monteiro & Parmiggiani, 2019). For example, "companies like Meta and Unity are constructing digital twins of our worlds with synthetic data to capture ever-evolving, complex interactions between people, objects, and their environments" (Monteiro et al., 2022, p. ix) in order to provide increasingly immersive, augmented experiences. At the same time, while these experiences become more valuable to end users at given points in time, we must not take for granted the data choices made by these companies for end users. Data have become both a medium for action and a resource asset; both a driver and an outcome of DT (Alaimo & Kallinikos, 2022). As such they determine many user choices a priori, without consent or the presentation of alternative choices (Zuboff, 2019). Thus, how data become assets for value creation and capture is not unproblematic.

For example, "data homogenization" may enable data to be stored, transmitted, processed and displayed across digital devices and networks (Yoo et al., 2010), "loosening the links between procedures of data making and domain knowledge" (Alaimo & Kallinikos, 2022, p. 24). However, as discussed earlier, such homogenization may not be collectively agreed upon, but rather determined by those who control the technologies that store, transmit, process, and display such data. Thus, such data homogenization may not represent diverse communities, perspectives, and beliefs (Bender et al., 2021). Further research needs to examine when data become valuable, for whom, and with what consequences.

4.5 | What possibilities of action can we perceive?

Sociotechnical perspectives on IS research have always stressed that technology has certain properties or capabilities but these afford different possibilities of action depending on the context of use (see Sarker et al. (2019)). Research in our review that takes a performative view of DT has similarly paid attention to the relational affordances of digital technology (Bailey et al., 2022; Leonardi & Vaast, 2017; Willems & Hafermalz, 2021). Digital technology is not transformational in itself; rather its transformational affordances are variably perceived and applied in practice. However, can we really observe relationality in practice, as it happens, in the performativity of action? Or can we only perceive the outcome of such relationality over time?

As Latour (1994, p. 35) famously said in one of his essays on technology mediation, "B-52s do not fly, the US Air Force flies," pointing at the performativity of action across human actors, technology, institutions, their properties, and competences. He added (1994, p. 35), "Full-fledged human actors, and respectable objects out there in the world, cannot be my starting point; they may be our point of arrival". This statement could not be more true today in the context of agents-in-the-loop, including both human and artificial actors (i.e. software agents) (Constantinides et al., 2024). Research on the ways by which humans perform tasks with artificial actors has shown that they intervene into one another's perception of the possibilities of action. For example, research has found that, artificial actors can, over time, homogenise the performance of human actors, since the latter lose their unique knowledge about what needs to be performed and learn to (blindly) follow the suggestions of artificial actors (Fügener et al., 2021). They perceive such suggestions as truthful and, consecquently, they become blind to other possible courses of action. Such myopia to the possibilities of actions may also be the result of selection and salience bias by human actors involved in the training of artificial actors (Balasubramanian et al., 2022).

This dynamic interaction between human and artificial actors in-the-loop, that is, those actors responsible for selecting which knowledge gets translated and transferred to other actors transforms our understanding of relational affordances. This new dynamic goes beyond the context of use—that is how a technology is used in situ—but rather challenges researchers to further untangle the genealogy of possibilities of action, including how the technology was designed, trained, and validated.

4.6 | Where is inertia and transformation constituted?

Finally, some papers in our review have stressed the importance of not taking for granted the people dimension of DT (Kane et al., 2019). DT involves a deeper investigation and understanding of the organisational identity of the firm undergoing transformation, including its cultural values and leadership attributes (Gioia, Patvardhan, et al., 2013). On the one hand, if those values and attributes are too rigid, the firm will face great inertia in responding to external challenges and its adaptive flexibility will be limited (Tripsas, 2009). On the other hand, if they are too loosely defined the firm will have no sense of purpose and will constantly drift to new fads that are short-lived and often unsuccessful. Firms' strategies and actions reflect the decisions of top executives (Gupta & Misangyi, 2018; Ravasi & Schultz, 2006), including chief digital officers who are responsible for managing and orchestrating digital initiatives (Tumbas et al., 2018).

However, the tensions surrounding the capabilities-rigidities paradox or the core competency trap (Leonard-Barton, 1992) have become more complex and multi-layered. As discussed above, organisations no longer operate within their own boundaries, but rather across ecosystems and modular, layered technologies. The task of strategic decision-making and of gaining new capabilities is no longer under the control of lone executives or hero entrepreneurs (Nambisan, 2017). More so, some capabilities are completely automated and distributed across machine learning technologies that can perform operations at a speed and scale that is unmatchable to human employees. Given the aforementioned field assumptions, DT is not contained within organisational boundaries. As such, identity, culture and leadership must transcend their organisational connotations across ecosystems of heterogeneous actors and technologies (Thomas & Ritala, 2022).

Further research needs to examine where the dual forces of inertia and transformation become constituted. As decisions on deploying cloud-based architectures, designing agile teams, and enabling open innovation across multiple and distributed sites of action are made, individual organisations and their executive managers will need to adapt their strategies to account for aggregate dynamics. This will challenge how we think of organisational identity and culture, including how those are shaped via external stakeholders, including customers, partners, competitors, and regulators.

5 | CONCLUSION

In this paper, we contribute to DT research by problematizing the literature across relevant disciplines. Our contributions align with the special issue's objectives. First, we offer compelling evidence of five pivotal research trajectories, each rooted in distinct assumptions. While these trajectories come with their own in-house assumptions, they also share broader field assumptions. Second, we scrutinise how studies within these research trajectories position themselves against earlier research, a process instrumental in constructing theoretical contributions. Our analysis reveals six distinct processes: synthesis, extension, negation of existing knowledge, identification of gaps, the completion of incomplete knowledge, and recognition of the incommensurability of our collective understanding. These processes hold true even in more recent research, demonstrating that they extend beyond our core corpus of studies. Importantly, we illuminate that DT is not a monolithic phenomenon but rather a complex, multidimensional one. Lastly,

and building from the above, we pose questions that challenge existing field assumptions that cut across all research trajectories in order to mobilise entirely new frontiers in DT research.

In closing, our problematization review offers an alternative approach to the systematic literature reviews that have largely dominated DT research. Both are valuable in their own right, but each serve different objectives and generate unique outcomes. Our problematization review has helped us to investigate and theorise the multi-dimensionality of DT. DT is emergent and indeterminate and yet it is uniquely perceived and framed by different researchers. We not only identify the diversity of perspectives and their underlying assumptions, we also demonstrate how DT is framed by different researchers. This problematization review enables us then to generate yet new dimensions of DT to be investigated and theorised by further research. We, thus, offer an epistemological approach to understanding not only how researchers frame and construct theoretical contributions, but also pave the way for new innovative DT research to take place.

CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

ORCID

Amir Ashrafi https://orcid.org/0000-0003-0475-8022
Panos Constantinides https://orcid.org/0000-0003-2728-8975

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AUTHOR BIOGRAPHIES

Amir Ashrafi is an Assistant Professor of Information Systems at the Brunel University London. He has published a number of papers in acclaimed journals, including Technological Forecasting & Social Change, International Journal of Information Management, Journal of Enterprise Information Management, and Journal of Business and Industrial Marketing. His research focuses on Digital Innovation & Transformation, AI, and Business Analytics. Email: amir.ashrafi@brunel.ac.uk

Panos Constantinides is a Professor of Digital Innovation at Alliance Manchester Business School (AMBS). He leads the Digital Transformation Research Group at AMBS and is one of the co-founders of the European Digital Platforms Research Network (EUDPRN). His research has been published in journals such as Information Systems Research, MIS Quarterly, the Journal of Business Venturing, and Organisation Studies, among others. Panos currently serves as a Senior Editor at MIS Quarterly and Senior Editor at Information & Organisation. He has served as a Senior Editor of the MISQ Special Issue on Building Digital Resilience against Major Shocks and as Senior Editor for the ISR Special Issue on Platforms and Infrastructures in the Digital Age. Email: panos.constantinides@manchester.ac.uk

Nikolay Mehandjiev is a Professor of Enterprise Information Systems at the Alliance Manchester Business School. He has initiated and managed projects worth €8 m, of which €5.3 m goes to the University of Manchester. The most recent project in which he participates is DIGICOR, a €10 m project involving Airbus and Comau. Before joining the University of Manchester, he was a lecturer in Information Systems at the University of Hull from 1995 to 1998. Email: n.mehandjiev@manchester.ac.uk

Dr. Jason Bennett Thatcher holds the Tandean Rustandy Esteemed Professorship at the Leeds School of Business at the University of Colorado-Boulder. He is also a Full Professor of Management Science at the Alliance Manchester Business School at the University of Manchester and an Honorary Professor at the University of Nottingham. He has also held visiting appointments at the Information Technology University-Copenhagen, the Technical University of Munich (TUM), the University of Augsburg, and the Hong Kong Polytechnic University. Jason studies individual decision-making, strategic alignment, and workforce issues related to the effective use of information technology in organisations. His more recent projects have focused on cybersecurity, social media, and digital upper echelons. Jason has published in journals such as MIS Quarterly, Information Systems Research, Journal of Applied Psychology, Harvard Business Review, and others. Jason's work appears in the Financial Times 50 journals about once a year. AISResearchRankings.Org ranked him as the most productive author on the AIS Senior Scholar list in 2014, 2020, and 2021. He has been ranked among the top scientists in the social sciences by Research.com and was named among the top 2% of most productive researchers in the world in a study published in PLOS Biology. Jason's work has received over 17 000 citations. Email: jason.thatcher@colorado.edu

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APPENDIX A

TABLE A1 Core corpus of DT.

Title	Authors-year	Outlet
Research commentary—the new organizing logic of digital innovation: an agenda for information systems research	Yoo et al. (2010)	Information Systems Research
Digital business strategy: toward a next generation of insights	Bharadwaj et al. (2013)	MIS Quarterly
Understanding digital transformation: A review and a research agenda	Vial (2019)	The Journal of Strategic Information Systems
Organising for innovation in the digitised world	Yoo et al. (2012)	Organisation Science
Toward a theory of ecosystems	Jacobides et al. (2018)	Strategic Management Journal
Digital Innovation Management: Reinventing innovation management research in a digital world	Nambisan et al. (2017)	MIS Quarterly
Research commentary-Platform evolution: Coevolution of platform architecture, governance, and environmental dynamics	Tiwana et al. (2010)	Information Systems Research
Bridging differing perspectives on technological platforms: Toward an integrative framework	Gawer (2014)	Research Policy
Digital entrepreneurship: Toward a digital technology perspective of entrepreneurship	Nambisan (2017)	Entrepreneurship theory and practice
Digital transformation strategies	Matt et al. (2015)	Business & Information Systems Engineering
Research commentary—Digital infrastructures: The missing IS research agenda. Information systems research	Tilson et al. (2010)	Information Systems Research
The digital platform: a research agenda	De Reuver et al. (2018)	Journal of information technology
An empirical investigation of net-enabled business value	Barua et al. (2004)	MIS Quarterly
Digital transformation: A multidisciplinary reflection and research agenda	Verhoef et al. (2021)	Journal of Business Research
Research commentary—The digital transformation of healthcare: Current status and the road ahead	Agarwal et al. (2010)	Information Systems Research
Digital affordances, spatial affordances, and the genesis of entrepreneurial ecosystems	Autio et al. (2018)	Strategic Entrepreneurship Journal
The digital transformation of innovation and entrepreneurship: Progress, challenges, and key themes	Nambisan et al. (2019)	Research Policy
Building dynamic capabilities for digital transformation: An ongoing process of strategic renewal	Warner and Wäger (2019)	Long range planning
Reflections on societal and business model transformation arising from digitization and big data analytics: A research agenda	Loebbecke and Picot (2015)	The Journal of Strategic Information Systems
Computing in everyday life: A call for research on experiential computing.	Yoo (2010)	MIS Quarterly
Innovation diffusion in global contexts: determinants of post-adoption digital transformation of European companies	Zhu et al. (2006)	European Journal of Information Systems
10 Sociomateriality: Challenging the Separation of Technology, Work and Organisation	Orlikowski and Scott (2008)	Academy of Management Annals

(Continues)

TABLE A1 (Continued)

Title	Authors-year	Outlet
When flexible routines meet flexible technologies: Affordance, constraint, and the imbrication of human and material agencies.	Leonardi (2011)	MIS Quarterly
Technology, identity, and inertia through the lens of "The Digital Photography Company"	Tripsas (2009)	Organisation Science
Digital innovation and transformation: An institutional perspective	Hinings et al. (2018)	Information and Organisation
On the fintech revolution: Interpreting the forces of innovation, disruption, and transformation in financial services	Gomber et al. (2018)	Journal of Management Information Systems
The generative mechanisms of digital infrastructure evolution	Henfridsson and Bygstad (2013)	MIS Quarterly
Platforms and infrastructures in the digital age	Constantinides et al. (2018)	Information Systems Research
Wakes of innovation in project networks: The case of digital 3-D representations in architecture, engineering, and construction	Boland et al. (2007)	Organisation Science
Disruptive technology: How Kodak missed the digital photography revolution	Lucas Jr and Goh (2009)	The Journal of Strategic Information Systems
The disruptive nature of information technology innovations: the case of internet computing in systems development organisations	Lyytinen and Rose (2003)	MIS Quarterly

TABLE A2 Coding of the core corpus.

Article	Illustrative quotations	First order codes (in-house assumptions)	Second order codes (field assumptions)	Aggregate dimension (research trajectory)
Yoo et al. (2010)	"Though Google Maps can be used as a standalone product, it can simultaneously be used in a variety of different ways, bundled with a host of heterogeneous devices such as desktop computers, mobile phones, televisions, cars, navigation systems, or digital cameras."	*Digital technology is built on layered and modular architectures that are product agnostic (i.e., they are software-based and thus can be reused and reprogrammed on multiple products) and shared by heterogeneous firms*	Technological modularity	Digital technology architectures
	"Any digital contents (audio, video, text, and image) can be stored, transmitted, processed, and displayed using the same digital devices and networks."	*Digital technology digitises and homogenises data to enable seamless access and sharing across devices and networks*	Digitization of data	
Tilson et al. (2010)	"…This flexibility is made possible by the malleability of software implementing the logic laid down in layers over the physical layer of interconnected hardware."	*Digital technology is built on layered and modular architectures that are product agnostic (i.e., they are software-based and thus can be reused and reprogrammed on multiple products) and shared by heterogeneous firms*	Technological modularity	
	"Then digital devices became capable of communicating, storing, and processing many types of information (device convergence), and the same network could support just about any information service."	*Digital technology digitises and homogenises data to enable seamless access and sharing across devices and networks*	Digitization of data	
Tiwana et al. (2010)	"…as most subsystems of an automobile are becoming digitised and connected through vehicle-based software architectures, an automobile has become a computing platform on which other firms outside the automotive industry can develop and integrate new devices, networks, services, and content."	*Digital technology gives rise to platform ecosystems—a type of meta-organisation—whereby a hub firm provides a set of core components upon which third party complements can be added.*	Technological modularity	
De Reuver et al. (2018)	"Digital technologies imply homogenization of data, editability, reprogrammability, distributedness and self-referentiality …, Such characteristics of digitality can lead to multiple inheritance in distributed settings, meaning there is no single owner that owns the platform core and dictates its design hierarchy"	*Digital technology enables open, distributed innovation across heterogeneous firms and third parties, but such innovation blurs organisational boundaries and raises tensions over who has control over the governance of digital technologies*	Innovation as distributed collective action	
Henfridsson and Bygstad (2013)	"…customers quickly embraced the laser printing of tickets, available at their work or home office. Indeed, the growth was so strong that by 2006 … online buyers of tickets were a majority of customers (85%).	*Digital technology is generative in that it can induce growth in modular components and users*	Technological modularity	

(Continues)

TABLE A2 (Continued)

Article	Illustrative quotations	First order codes (in-house assumptions)	Second order codes (field assumptions)	Aggregate dimension (research trajectory)
	This convinced top management that the Internet strategy was paying off, and that the airline should further exploit the momentum of growth. Accordingly, with more users adopting the infrastructure services, more resources were allocated to improve and extend the infrastructure."			
Lyytinen and Rose (2003)	"Internet computing, therefore, offered a new mechanism that unified interactions over open networks and made it possible to execute distributed transactions and to build radically new types of services. These unforeseen services could be further vertically integrated with legacy platforms that resulted in the additional integrative capabilities of Internet computing."	*Digital technology enables open, distributed innovation across heterogeneous firms and third parties, but such innovation blurs organisational boundaries and raises tensions over who has control over the governance of digital technologies*	Innovation as distributed collective action	
Yoo et al. (2012)	"… the reduction of communication and coordination cost as a result of information technology has led to a geographical dispersion of innovation activities"	*Digital technology enables open, distributed innovation across heterogeneous firms and third parties, but such innovation blurs organisational boundaries and raises tensions over who has control over the governance of digital technologies*	Innovation as distributed collective action	
Nambisan et al. (2017)	"…Accordingly, digital innovation can be viewed as a constant search for and identification of new or evolved problem–solution pairs. Such searches may initially focus on replacing existing functions. Over time, these searches may create complements to existing products or services or largely decompose or restructure the current product architecture to several separate layers. As layers are introduced (such as "software stacks"), highly distinct design-solution pairs can be sought to offer new recombination possibilities as well as the potential for open innovation."	*Digital technology is built on layered and modular architectures that are product agnostic (i.e., they are software-based and thus can be reused and reprogrammed on multiple products) and shared by heterogeneous firms.*	Technological modularity	
Yoo (2010)	"The design and construction of experiential computing services and products that take advantage of digitally mediated experiences require integration across previously separate industries and product lines. When Nike and Apple introduced the convergence of running shoes and MP3 players, this created a challenging knowledge integration	*Digital technology is built on layered and modular architectures that are product agnostic (i.e., they are software-based and thus can be reused and reprogrammed on*	Technological modularity	

TABLE A2 (Continued)

Article	Illustrative quotations	First order codes (in-house assumptions)	Second order codes (field assumptions)	Aggregate dimension (research trajectory)
	problem. As traditionally non-digital products and services have very different life cycles and customer expectations, the way those products and services are designed and implemented require a very different infrastructure and set of knowledge resources."	*multiple products) and shared by heterogeneous firms*		
Boland et al. (2007)	"…a growing body of innovation research has shifted its focus from a single innovator to a network of heterogeneous actors… Studies of the communal and networked features of innovation show that increased network diversity promotes new combinations, fosters learning, and enables faster diffusion, but at the same time, it can build thicker boundaries that inhibit their spread."	*Digital technology enables open, distributed innovation across heterogeneous firms and third parties, but such innovation blurs organisational boundaries and raises tensions over who has control over the governance of digital technologies*	*Innovation as distributed collective action*	
Bharadwaj et al. (2013)	"Furthermore, the use of digital platforms enables firms to break traditional industry boundaries and to operate in new spaces and niches that were earlier only defined through those digital resources."	*Digital technology has changed the nature of competition from local to global and from physical products to digital services, intensifying rivalry even between companies that have not traditionally operated in similar markets*	Economics of scale and scope	Digital business models and new forms of value creation
Matt et al. (2015)	"The exploitation and integration of digital technologies often affect large parts of companies and even go beyond their borders, by impacting products, business processes, sales channels, and supply chains."	*Digital technology has changed the nature of competition from local to global and from physical products to digital services, intensifying rivalry even between companies that have not traditionally operated in similar markets.*	Economics of scale and scope	
Agarwal et al. (2010)	"There is substantial consensus that the digital transformation of healthcare through broad and deep use of health information technology (HIT) across the health-care ecosystem, in conjunction with other complementary changes, can reduce costs and improve quality …."	*Digitalization of business processes and digitization of data have generated cost efficiencies, and better customer experiences*	Economics of scale and scope	
	""with the digitization of health records, HIT systems can capture real-time information on patients' response to prescribed treatments,	*Digitalization of business processes and digitization of data have generated cost efficiencies, and better customer experiences.*	Digitization of daata	

(Continues)

TABLE A2 (Continued)

Article	Illustrative quotations	First order codes (in-house assumptions)	Second order codes (field assumptions)	Aggregate dimension (research trajectory)
	providing additional data for the design and refinement of new treatments."			
Barua et al. (2004)	"…improved informational capabilities have a direct impact on customer satisfaction, buying experience, and loyalty. Therefore, OIC entails operational benefits on both customer and suppler sides. The improved operational benefits from customer and supplier interactions can be linked to financial performance in order to assess business value."	*Digitalization of business processes and digitization of data have generated cost efficiencies, and better customer experiences*	Digitization of data	
Vial (2019)	"Organisations use digital technologies to transition from or augment the sales of physical products with the sales of services as an integral part of their value proposition to satisfy the needs of customers by offering innovative solutions …. … Netflix… business model was originally based on the rental of movies stored on physical media. Over the years, Netflix has moved away from this value proposition to become the first large-scale provider of video streaming services."	*Digital technology has enabled new business models, including software-as-a-service that can generate economies of scale and scope*	Technological modularity & Economics of scale and scope	
Verhoef et al. (2021)	"…digitalization is not only focused on cost savings, but also includes process improvements that may enhance customer experiences."	*Digitalization of business processes and digitization of data have generated cost efficiencies, and better customer experiences.*	Digitization of data	
	"Mobile devices have become important in today's consumer behaviour …. Consumers also strongly rely on apps, and new AI-based technologies, …, that are entering consumers' lives. These … structurally change consumer behaviour, and, consequently, the use of new digital technologies can easily become the new norm and defy traditional business rules."	*Greater pressure by consumers for on-demand, personalised access to digital services through smart devices has changed processes of value co-creation*	Economics of scale and scope	
Loebbecke and Picot (2015)	"With processing, storage and transmission of data available on a massive scale at extremely low cost, digitization has the capacity to change almost any form of human labor (and lifestyle) that is directly or indirectly associated with data and cognitive non-routine processes"	*Digitalization of business processes and digitization of data have generated cost efficiencies, and better customer experiences.*	Digitization of data	
Zhu et al. (2006)	"When e-business is used across a wider scope of value-chain activities and in a substantial proportion for each of them, the fixed investments in e-business can be spread over more business activities, thus	*Digital technology has enabled new business models, including software-as-a-service that can generate economies of scale and scope.*	Economics of scale and scope	

TABLE A2 (Continued)

Article	Illustrative quotations	First order codes (in-house assumptions)	Second order codes (field assumptions)	Aggregate dimension (research trajectory)
	increasing cost-effectiveness. Further, as diversified business activities are migrated over the Internet-enabled, open standard platform, companies are more likely to connect various systems to support a variety of value-chain activities."			
Warner and Wäger (2019)	"In the past, the products, customers, and sales channels remained the same. Now, you are in a situation where customers basically change. […] At the same time, you have new competitors moving in, who are entirely new."	*Digital technology has changed the nature of competition from local to global and from physical products to digital services, intensifying rivalry even between companies that have not traditionally operated in similar markets*	Economics of scale and scope	
Gomber et al. (2018)	"the cost to launch a tech start-up began dropping because of open-source software (e.g., the Tensorflow library to support machine intelligence, www.tensorflow.org), and easily scalable infrastructure (via Amazon Web Services, Google Cloud, etc.). This has allowed new entrants into the market to create niche products that target very specific groups of customers based on their characteristics."	*Digital technology has enabled new business models, including software-as-a-service that can generate economies of scale and scope*	Technological modularity & Economics of scale and scope	
Jacobides et al. (2018)	"Nepresso, …, grew into one of Nestle's most profitable units precisely by taking the generic complementarities between coffee and coffee-making machine and making them specific. They did so by putting the coffee into capsules (and later pods), encouraging the design of co-specialised machines for these capsules, produced by major outside producers such as Braun and Krups."	*Ecosystem relationships depend on the co-specialisation of resources and capabilities of diverse firms (including startups) such that resource A depends on resource B for a core value proposition to emerge (e.g., smart energy meters & smart home apps).*	Technological modularity	New organisational forms enabled by digital technologies
Gawer (2014)	"a technological platform (for example the Nintendo Wii game console) endowed with an initially larger installed base of end-users (gamers) will have the effect of increasing the incentives for developers of complementary products or services (here, video game developers) to join the Wii platform and develop Wii-compatible videogames; this increased provision of complements would, in turn, help to attract more end-users to the Wii platform."	*Platform ecosystems enable open, distributed innovation across entrepreneurial networks and third parties but require a specific set of governance mechanisms to be sustainable*	Economics of scale and scope	

(Continues)

TABLE A2 (Continued)

Article	Illustrative quotations	First order codes (in-house assumptions)	Second order codes (field assumptions)	Aggregate dimension (research trajectory)
Autio et al. (2018)	"As digital platforms can support a wide variety of value propositions in a wide range of markets, new ventures in entrepreneurial ecosystems typically do not directly compete against one another. In contrast, new ventures exploiting digital platforms for business model experimentation will have an incentive to share their experiences, as reciprocal sharing of such knowledge will help all occupants of the entrepreneurial ecosystem become more effective in business model innovation."	*Digital technology gives rise to platform ecosystems—a type of meta-organisation—whereby a hub firm provides a set of core components upon which third party complements can be added*	Economics of scale and scope	
Nambisan (2017)	"…characteristics of the enabling digital technologies could fundamentally shape the scope and the nature of distributed entrepreneurial agency—for example, new functions offered by the digital infrastructure (e.g., crowdsourcing system) could likely shape the "architecture of participation"."	*Platform ecosystems enable open, distributed innovation across entrepreneurial networks and third parties but require a specific set of governance mechanisms to be sustainable.*	Technological Modularity & Innovation as Distributed Action	
Constantinides et al. (2018)	"As software developers create new applications and services to be traded on application marketplaces, they attract consumers and advertisers who generates both same-side and cross-side network effects. Such openness promotes ecosystems based on multiple and diverse value propositions, while also serving excess rents for the platform host or owner."	*Ecosystem relationships depend on the co-specialisation of resources and capabilities of diverse firms (including startups) such that resource A depends on resource B for a core value proposition to emerge (e.g., smart energy meters & smart home apps).*	Technological modularity	
	"Blockchain infrastructure holds out great promise, to increase the speed of exchange, reduce the number of intermediaries and associated costs, improve security, digitise assets, give wider access to disadvantaged groups …"	*Platform ecosystems enable open, distributed innovation across entrepreneurial networks and third parties but require a specific set of governance mechanisms to be sustainable*	Innovation as distributed collective action	
Nambisan et al. (2017)	"…collaboration among collectives is enabled by such digital infrastructural capabilities as knowledge sharing and work execution platforms (e.g., GitHub), crowdsourcing (e.g., Top Coder), crowdfunding (e.g., Kickstarter), virtual worlds (e.g., Second Life), digital makerspaces, and dedicated social media (e.g., OpenStack)."	*Platform ecosystems enable open, distributed innovation across entrepreneurial networks and third parties but require a specific set of governance mechanisms to be sustainable*	Innovation as distributed collective action	

TABLE A2 (Continued)

Article	Illustrative quotations	First order codes (in-house assumptions)	Second order codes (field assumptions)	Aggregate dimension (research trajectory)
Nambisan et al. (2019)	"… openness of the technological architecture that underlie a digital platform allows for external entities to build on (and complement) one another's contributions (innovation outputs)."	*Platform ecosystems enables open innovation across entrepreneurial networks and third parties but require a specific set of governance mechanisms to be sustainable*	Innovation as distributed collective action	
Orlikowski and Scott (2008)	"… when Internet search engine software "runs" or is executed, a set of choices-as-embedded-in-code shape the operation of the search engine, the databases and indexes that are built and maintained, and the results that are returned to users. A Web search conducted with the Google search engine is sociomaterial "all the way down", entailing computer code written and updated by software engineers, executing on computers …, and whose operation depends on the millions of people who use computers to create and update Web pages every day, and the millions of people around the world who enter particular search criteria into their Web browsers…."	*Digital technology affords opportunities for action that can transform existing work practices. It is relational to those using it, including their political agendas and power struggles with other actors.*	Relational affordances	Digital technology affordances and the relationality of work practices
Leonardi (2011)	"… people can alter the performance of a routine—their patterns of social interaction—while still main taining its ostensive qualities—the broad understanding of what the routine should do. Technologies are also increasingly flexible in the sense that people have resources to reinvent, redesign, and reconfigure their material features so that the technology does new things. Thus, when people work with both flexible routines and flexible technologies and wish to change their work practices, it seems that they have a choice. Do they change the routine, or do they change the technology?"	*Digital technology affords opportunities for action that can transform existing work practices. It is relational to those using it, including their political agendas and power struggles with other actors*	Relational affordances	
Tripsas (2009)	"When identity-challenging technology is noticed, identity-based beliefs may colour interpretations of it or established routines may preclude participation. …, the self-reinforcing dynamics among identity, organisational action, and the industry and technological context create a strong impediment to change." (Tripsas, 2009)	*Organisational identity is both internally defined by senior management and embodied in the culture of work, but also externally reacted to by partners, customers, and other stakeholders. DT may be enabled if it aligns with organisational identity or resisted if it contests that identity*	Organisational inertia	The role of organisational identity, culture, and leadership in DT

(Continues)

TABLE A2 (Continued)

Article	Illustrative quotations	First order codes (in-house assumptions)	Second order codes (field assumptions)	Aggregate dimension (research trajectory)
	"organisational identity serves a coordinating role, providing a focal point for both insiders and outsiders about what constitutes legitimate action on the part of an organisation." (Tripsas, 2009)	*Digital technology must be legitimised internally (against organisational capabilities and practices) and externally (against the capabilities of digital technology partners)*		
Lucas Jr and Goh (2009)	"The old-line manufacturing culture continues to impede Fisher's efforts to turn Kodak into a high-tech growth company. Fisher has been able to change the culture at the very top. But he hasn't been able to change the huge mass of middle managers, and they just don't understand this [digital] world."	*Organisational identity is both internally defined by senior management and embodied in the culture of work, but also externally reacted to by partners, customers, and other stakeholders. DT may be enabled if it aligns with organisational identity or resisted if it contests that identity*	Organisational inertia	
Agarwal et al. (2010)	"To help design, select, and implement HIT applications, one promising approach is to focus analysis at the level of the physician's workflow. …. There is a strong culture in healthcare aimed at routinizing workflows to minimise risk and enhance efficiency…. Therefore, routinization of HIT into daily workflows for better performance might well be the key to achieving meaningful use. Thus, EHR systems need to be designed to better support clinical workflows, and hospitals and medical practices need to pick the HIT solution that best fits their workflows."	*Core values, power distribution (e.g., between professions or business units) and control mechanisms within organisations shape processes of DT.*	Organisational inertia	
Hinings et al. (2018)	"From an institutional perspective, organisations cannot be understood without taking account of the influence of this institutional context. Organisations are seriously constrained by social expectations and the social approval—legitimacy—of particular actions and ways of organising."	*Digital technology must be legitimised internally (against organisational capabilities and practices) and externally (against the capabilities of digital technology partners).*	Organisational inertia	

TABLE A2 (Continued)

Article	Illustrative quotations	First order codes (in-house assumptions)	Second order codes (field assumptions)	Aggregate dimension (research trajectory)
Vial (2019)	"…organisational culture, identity and legitimacy form strong institutional barriers that hinder the development of smart services."	*Organisational identity is both internally defined by senior management and embodied in the culture of work, but also externally reacted to by partners, customers, and other stakeholders. DT may be enabled if it aligns with organisational identity or resisted if it contests that identity*	Organisational inertia	

Note: (a) Nambisan (2017) is placed under research trajectories 1&3 as it is a review paper and covered themes from both trajectories; (b) Agarwal et al. (2010) is placed under research trajectories 2&5 as it is an editorial paper and explored themes from both trajectories; (c) Vial (2019) is placed under research trajectories 2&5 as it is a review paper and covered themes from both trajectories.